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PROJECT CHECO SOUTHEAST ASIA REPORT

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PROJECT
Contemporary
Historical
Examination of
Current
Operations
REPORT

COMMANDO VAULT (U)

12 OCTOBER 1970

HQ PACAF
Directorate, Tactical Evaluation
CHECO Division

Prepared by:
MELVIN F. PORTER
Project CHECO 7th AF, DOAC

[redacted]

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS PACIFIC AIR FORCES
APO SAN FRANCISCO 96553

OFFICE OF THE CHIEF OF STAFF

PROJECT CHECO REPORTS

The counterinsurgency and unconventional warfare environment of Southeast Asia has resulted in the employment of USAF airpower to meet a multitude of requirements. The varied applications of airpower have involved the full spectrum of USAF aerospace vehicles, support equipment, and manpower. As a result, there has been an accumulation of operational data and experiences that, as a priority, must be collected, documented, and analyzed as to current and future impact upon USAF policies, concepts, and doctrine.

Fortunately, the value of collecting and documenting our SEA experiences was recognized at an early date. In 1962, Hq USAF directed CINCPACAF to establish an activity that would be primarily responsive to Air Staff requirements and direction, and would provide timely and analytical studies of USAF combat operations in SEA.

Project CHECO, an acronym for Contemporary Historical Examination of Current Operations, was established to meet this Air Staff requirement. Managed by Hq PACAF, with elements at Hq 7AF and 7AF/13AF, Project CHECO provides a scholarly, "on-going" historical examination, documentation, and reporting on USAF policies, concepts, and doctrine in PACOM. This CHECO report is part of the overall documentation and examination which is being accomplished. Along with the other CHECO publications, this is an authentic source for an assessment of the effectiveness of USAF airpower in PACOM.

ROLAND G. CAMPBELL, Major General, USAF
Chief of Staff

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS PACIFIC AIR FORCES
APO SAN FRANCISCO 96553

REPLY TO ATTN OF: DOVD

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FOR THE COMMANDER IN CHIEF

Maurice L. Griffith

MAURICE L. GRIFFITH, Colonel, USAF
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   - c. AFCSA
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     - (2) AFCSAMI 1
   - d. AFOA. 2
   - e. AFIGO
     - (1) OSIUAM. 3
     - (2) IGS 1
   - f. AFSG. 1
   - g. AFNIATC 5
   - h. AFAAC 1
     - (1) AFACMI 1
   - i. AFODC
     - (1) AFPRC 1
     - (2) AFPRE 1
     - (3) AFPRM 1
   - j. AFPDC
     - (1) AFDPXPS. 1
     - (2) AFDPMD 1
     - (3) AFDPW. 1
   - k. AFRD 1
     - (1) AFRDP. 1
     - (2) AFRDQ. 1
     - (3) AFRDOPC. 1
     - (4) AFRDR. 1
     - (5) AFRDQL 1
   - l. AFSDC
     - (1) AFSLP. 1
     - (2) AFSME. 1
     - (3) AFSMS. 1
     - (4) AFSSS. 1
     - (5) AFSTP. 1
   - m. DA-AA. 1
   - n. AFXO 1
     - (1) AFXOD. 1
     - (2) AFXODC 1
     - (3) AFXODD 1
     - (4) AFXODL 1
     - (5) AFXOOAB. 1
     - (6) AFXOSL 1
     - (7) AFXOOSN. 1
     - (8) AFXOOSO. 1
     - (9) AFXOOSS. 1
     - (10) AFXOOSV. 1
     - (11) AFXOOTR. 1
     - (12) AFXOOTW. 1
     - (13) AFXOOTZ. 1
     - (14) AFXOOCY. 1
     - (15) AF/XOX 6
     - (16) AFXOXXG. 3

3. MAJOR COMMAND

a. TAC

(1) HEADQUARTERS
- (a) DO. 1
- (b) XP. 2
- (c) DOCC. 1
- (d) DREA. 1
- (e) INO 1

(2) AIR FORCES
- (a) 12AF
  - 1. DOO. 1
  - 2. IN 1
- (b) 19AF(IN). 1
- (c) USAFSOF(DO) 1

(3) WINGS
- (a) 1SOW(DOI) 1
- (b) 23TFW(DOI). 1
- (c) 27TRW(DOI). 1
- (d) 33TFW(DOI). 1
- (e) 64TAW(DOI). 1
- (f) 67TRW(C). 1
- (g) 75TRW(DOI). 1
- (h) 316TAW(DOP) 1
- (i) 317TAW(EX). 1
- (j) 363TRW(DOI) 1
- (k) 464TFW(DOIN). . . . 1
- (l) 474TFW(TFOW). . . . 1
- (m) 479TFW(DOI) 1
- (n) 516TAW(DOPL). . . . 1
- (o) 4403TFW(DOI). . . . 1
- (p) 58TAC FTR TNG WG. . 1
- (q) 4554CCTW(DOI) . . . 1

(4) TAC CENTERS, SCHOOLS
- (a) USAFTAWC(DA). . . . 2
- (b) USAFTARC(IN). . . . 2
- (c) USAFTALC(DAL) . . . 1
- (d) USAFTFWC(DRA) . . . 1
- (e) USAFAGOS(EDA) . . . 1

b. SAC

(1) HEADQUARTERS
- (a) DOPL. 1
- (b) XPX 1
- (c) DM. 1
- (d) IN. 1
- (e) OA. 1
- (f) HO. 1

(2) AIR FORCES
- (a) 2AF(INCS) 1
- (b) 8AF(DO) 2
- (c) 15AF(IN). 1

c. MAC

(1) HEADQUARTERS
- (a) DOI 1
- (b) DOO 1
- (c) CSEH. 1
- (d) MACOA 1

(2) AIR FORCES
- (a) 22AF(OCXI). 1

(3) MAC SERVICES
- (a) AWS(AWCHO). 1
- (b) ARRS(XO). 1
- (c) ACGS(CGO) 1

d. ADC

(1) HEADQUARTERS
- (a) DO. 1
- (b) DOT 1
- (c) XPC 1

(2) AIR DIVISIONS
- (a) 25AD(IN). 1
- (b) 29AD(DO). 1
- (c) 20AD(IN). 1

e. ATC

(1) ATXPP-X 1

f. AFLC

(1) HEADQUATERS
- (a) XOX 1

g. AFSC

(1) HEADQUARTERS
- (a) XRP 1
- (b) XRLW. 1
- (c) SAMSO(XRW). 1
- (d) SDA 1
- (e) CSH 2
- (f) DLXP. 1
- (g) ASD(ADJT) 1
- (h) ESD(XO) 1
- (i) RADC(EMOTL) 2
- (j) ADTC(CCS) 1
- (k) ADTC(SSLT). 1
- (l) ESD(YW) 1
- (m) AFATL(DL) 1

h. USAFSS

(1) HEADQUARTERS
- (a) ODC 1
- (b) CHO 1

(2) SUBORDINATE UNITS
- (a) Eur Scty Rgn(OPD-P) . 1
- (b) 6940 Scty Wg (OOD). . 1

i. AAC

(1) HEADQUARTERS
- (a) ALDOC-A. 1

j. USAFSO

(1) HEADQUARTERS
- (a) CHS. 1

k. PACAF

(1) HEADQUARTERS
- (a) DP 1
- (b) IN 1
- (c) XP 2
- (d) CSH. 1
- (e) DOVD 5
- (f) DC 1
- (g) DM 1

(2) AIR FORCES
- (a) 5AF
  - 1. CSH 1
  - 2. XP. 1
  - 3. DO. 1
- (b) Det 8, ASD(DOASD). . 1
- (c) 7AF
  - 1. DO. 1
  - 2. DIP 1
  - 3. XP. 1
  - 4. DOCT. 1
  - 5. DOAC. 2
- (d) 13AF
  - 1. CSH 1
  - 2. XP. 1
- (e) 7/13AF(CHECO). . . . 1

(3) AIR DIVISIONS
- (a) 313AD(DOI) 1
- (b) 314AD(XP). 2
- (c) 327AD
  - 1. DO. 1
  - 2. IN. 1
- (d) 834AD(DO). 2

(4) WINGS
- (a) 8TFW(DOEA) 1
- (b) 12TFW(DOIN). 1
- (c) 35TFW(DOIN). 1
- (d) 56SOW(WHD) 1
- (e) 347TFW(DO) 1
- (f) 366TFW(DO) 1
- (g) 388TFW(DO) 1
- (h) 405FW(DOEA). 1
- (i) 432TRW(DOI). 1
- (j) 460TRW(DOI). 1
- (k) 475TFW(DCO). 1
- (l) 1st Test Sq(A) 1

(5) OTHER UNITS
- (a) Task Force ALPHA(IN) . . 1
- (b) 504TASG(DO). 1
- (c) Air Force Advisory Gp. . 1

m. USAFE

(1) HEADQUARTERS
- (a) DOA. 1
- (b) DOLO 1
- (c) DOO. 1
- (d) XDC. 1

(2) AIR FORCES
- (a) 3AF(DO). 2
- (b) 16AF(ODC). 1
- (c) 17AF(IN) 1

(3) WINGS
- (a) 36TFW(DCOID) 1
- (b) 50TFW(DOA) 1
- (c) 66TRW(DCOIN-T) 1
- (d) 81TRW(DCOI). 1
- (e) 401TFW(DCOI) 1
- (f) 513TAW(OID). 1

(4) GROUPS
- (a) 497RTG(IRCOD). 5

4. SEPARATE OPERATING AGENCIES
- a. ACIC(DOP). 2
- b. AFRES(XP). 2
- c. AU
  - 1. ACSC-SA 1
  - 2. AUL(SE)-69-108. . . . 2
  - 3. ASI(ASD-1). 1
  - 4. ASI(HOA). 2
- d. AFAFC(CEH) 1
- e. ANALYTIC SERVICES, INC . 1

5. MILITARY DEPARTMENTS, UNIFIED AND SPECIFIED COMMANDS, AND JOINT STAFFS

a. COMUSJAPAN 1
b. CINCPAC (SAG). 1
c. CINCPAC (J301) 1
d. CINCPACFLT (Code 321). 1
e. COMUSKOREA (ATTN: J-3) 1
f. COMUSMACTHAI 1
g. COMUSMACV (TSCO) 1
h. COMUSTDC (J3). 1
i. USCINCEUR (ECJB) 1
j. USCINCSO (DCC) 1
k. CINCLANT (0021). 1
l. CHIEF, NAVAL OPERATIONS. 1
m. COMMANDANT, MARINE CORPS (HQMC). 1
n. CINCONAD (CHSV-M). 1
o. DEPARTMENT OF THE ARMY (TAGO). 1
p. JOINT CHIEFS OF STAFF (J3RR&A) 1
q. JSTPS. 1
r. SECRETARY OF DEFENSE (OASD/SA) 1
s. CINCSTRIKE (STRJ-3). 1
t. CINCAL (HIST). 1
u. MAAG-CHINA/AF Section (MGAF-0) 1
v. HQ ALLIED FORCES NORTHERN EUROPE (U.S. DOCUMENTS OFFICE) 1
w. USMACV (MACJ031) 1

6. SCHOOLS

a. Senior USAF Representative, National War College 1
b. Senior USAF Representative, Armed Forces Staff College 1
c. Senior USAF Rep, Industrial College of the Armed Forces. 1
d. Senior USAF Representative, Naval Amphibious School. 1
e. Senior USAF Rep, U.S. Marine Corps Education Center. 1
f. Senior USAF Representative, U.S. Naval War College 1
g. Senior USAF Representative, U.S. Army War College. 1
h. Senior USAF Rep, U.S. Army C&G Staff College 1
i. Senior USAF Representative, U.S. Army Infantry School. 1
j. Senior USAF Rep, U.S. Army JFK Center for Special Warfare. . . . 1
k. Senior USAF Representative, U.S. Army Field Artillery School . . 1
l. Senior USAF Representative, U.S. Liaison Office. 1

7. SPECIAL

a. The RAND Corporation 1
b. U.S. Air Attache, Vientiane. 1

TABLE OF CONTENTS

FIGURES

FOREWORD

Attempts to create helicopter landing zones through the use of tactical strikes were made as early at October 1966 in the eastern II Corps Tactical Zone (CTZ) under Operation Irving, only to meet with a conspicuous lack of success. As a forward air controller (FAC) reported after one such operation:[1]

> *"Finally, toward the end of the day, we had four connecting craters out of at least 20 attempted bombs, but the final evaluation by the ground commander was that, although we had cleared the area, the terrain was too much of a slope or too rough to use as an LZ anyway; so there was a waste of about four sorties."*

Another FAC in the same operation ruefully recalled that[2]

> *". . . after expending five flights of fighters, we still didn't have an LZ that you could land a chopper in. . . . In many cases we expended a great deal of ordnance in an area and never actually constructed an LZ."*

The general opinion of the FACs and air liaison officers (ALOs) after the over-all operation was that the use of a tactical air effort to construct LZs for the Army was "quite a waste of tactical airpower." Even after sufficient strikes had been put in to clear the area, the resulting craters usually made the landing zone unsuitable for helicopter operations.

This report follows the evolution of a different concept: that of dropping a "big" bomb from a transport type aircraft to create "instant" helicopter landing zones in Southeast Asia (SEA)--from inception, through development and testing, to eventual adoption as a standard, highly successful operational tactic which would stand as an exemplar of inter-service cooperation.[3]

[redacted]

CHAPTER I

BACKGROUND

On 20 November 1967, the Military Assistance Command, Vietnam (MACV) Scientific Adviser Office requested assistance from the SEA Mobile Explosive Ordnance Disposal (EOD) team at Tan Son Nhut AB, RVN, in helping to design a method for explosively clearing helicopter landing zones in heavy jungle terrain. Under a project later to be known as Combat Trap/Commando Vault, it was decided to try the M118 3,000-lb. demolition bomb for this purpose. On 9 December 1967 the bomb, together with the necessary equipment, was flown to Dak To, in northwestern II Corps, and placed nose-down on a wooden rack 20 inches above the ground. Later in the day, an Army CH-47 helicopter airlifted the platform and lowered it onto the selected site in heavy jungle near Dak To, while EOD personnel set up booby traps at distances of 10, 50, 100, and 150 feet from the bomb. On 10 December 1967, when the EOD team detonated the weapon, the jungle was cleared for an area about 150 feet wide, and all booby traps were either detonated or disabled by the blast. 4/

As a result of this helicopter landing zone evaluation, MACV directed Seventh Air Force (7AF) to develop the capability of delivering specialized ordnance for clearing such heavily-jungled areas. Use of the M1 fuze extender on Mk 84 and M118 bombs gave 7AF a partial capability in this direction. 5/

The Armament Development and Test Center at Eglin AFB, Florida, also conducted tests between 29 April and 31 July 1968 to obtain tree-clearing

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data on the blast effects of 1,000-lb. samples of two different explosives--DBA-22L and Astrolite A-1-5--using Tritonal* as a base comparison.[6] The explosives were loaded into BLU-1B/B (fire bomb) casings to minimize fragmentation effect, then statically detonated in a forested area to work up peak overpressure and effects data.[7]

Each test site consisted of a 150-foot-diameter circle of trees, similar in density, size, and type to those which might be encountered in Southeast Asia. At the center of each test site were four or more large trees, at least one of which had to be over 18 inches in diameter and located within 15 feet of target center. Fifteen detonations, with various combinations of fuzing and height of the bomb above the ground, yielded pressure data and gave a rough indication of tree-clearing capability.[8]

Under the conditions of the tests, it was found that 1,000-lb. bombs containing any of the three types of explosives failed to clear a forest area suitable for helicopter landing operations.[9] Thus, it became obvious that, if "instant" helicopter landing zones were to be constructed in forest or jungle of any real density, far heavier munitions (even heavier than the Mk 84 and M118 bombs already tested in South Vietnam) would have to be employed. Simultaneously, the U.S. Army began tests of the M121 10,000-lb. bomb at Fort Benning, Georgia. This monster, in storage since the retirement of the B-36 bomber, was statically detonated

*Tritonal was composed of 80 per cent TNT and 20 per cent powdered aluminum.

[redacted]

in a wooded artillery range. While the results were satisfactory, practical considerations demanded aerial delivery for any employment in Southeast Asia. As a result, the M121 was modified and redesigned to contain two independent fuzing systems, one forward and one aft, as well as a stabilization parachute. Continued testing with inert bombs on western test ranges, using both the Army's CH-54 "Flying Crane" helicopter and the Air Force's C-130, demonstrated the feasibility of using the latter as a "bomber," but eventually resulted in a decision to abandon further employment of the big helicopter in this role. 10/

In December 1968, the 834th Air Division, headquartered at Tan Son Nhut Air Base, RVN, conducted a ten-weapon operational test of the M121 in South Vietnam, again under the code name Combat Trap. 11/ From these inchoate experiments eventually evolved the operational concept called Commando Vault, which was subsequently to be tested and evaluated, then employed regularly in Southeast Asia.

CHAPTER II

INTRODUCTION OF THE SYSTEM TO SOUTHEAST ASIA

COMUSMACV's original request had stated that the desideratum was for landing zones of five-helicopter size and that development efforts should be concentrated on the largest weapon compatible with C-130 delivery.[12/] In the dense jungle environment normally encountered in Southeast Asia, even the largest weapon then in the inventory--the 10,000-lb. M121--was inadequate to this demand. Experience showed that when target selection criteria were closely adhered to (i.e., basically level terrain and within MSQ-77/TPQ-10 radar accuracy parameters), the M121 would effectively clear a one or two-ship landing zone a little over 90 per cent of the time.[13/]

A series of messages between November 1968 and February 1969 discussed the question of what munition to use. Should new weapons be developed, production be resumed on old ones, "super heavy" (25,000 to 35,000-lb.) bombs be considered, or new, more powerful high explosives be adapted for use with smaller casings? All of these alternatives were weighed and pondered.[14/] The inventory of M121s was extremely low, and the Office of the Air Force Chief of Staff (CSAF) favored resumption of production of the weapon. In response to this high-level preference, the Air Force Weapons Laboratory, Special Applications Branch at Kirtland AFB, Albuquerque, New Mexico, devoted its early efforts to adapting the M121 bomb to the new role.

Since the quantity of existing M121s was so limited as to offer little future practical employment, unless their manufacture were resumed,

[redacted]

The Air Force Weapons Laboratory's Special Applications Branch concluded that it might be advantageous to try a new explosive, DBA-22M, which had been developed for Sandia Laboratories, and load it into a larger bomb casing. As a result, in early December 1968 the Air Force requested Sandia, through the Albuquerque Operations Office of the Atomic Energy Commission, to design and develop a possible follow-on bomb to the M121, weighing 15,000 pounds and filled with the gelled-slurry explosive DBA-22M. The resulting design and development program lasted approximately one year, winding up in the autumn of 1969. With the development program completed, the Air Force requested the Albuquerque Operations Office of the AEC to undertake, through Sandia Laboratories, the fabrication of 225 emergency-capability 15,000-lb, BLU-82/B bombs. Simultaneously, program management was transferred from the Special Applications Branch at Kirkland AFB to the Armament Development and Test Center at Eglin AFB, Florida. 15/

During this period, tests of a 15,000-lb. gelled-slurry, explosive-filled bomb were being conducted at Tonopah Test Range, Nevada, in connection with the Cloudmaker Program. This was followed by the first live, full-scale test drop of a BLU-82/B at the Tonopah Test Range on 1 April 1969, the rigging of the bomb and its cradle to the Air Force aerial delivery platform having been performed at El Centro Naval Air Facility (NAF), California. The rigged bomb was loaded on a C-130 aircraft and the drop staged out of Hill AFB, Utah. The bomb impacted on one of the large dry lake bed targets at the Tonopah Range. Informed of this test,

[redacted]

Seventh Air Force recommended that any decision on whether or not to produce the M121 be delayed until the results of the Nevada desert drop could be evaluated.[16/]

In its protest against resumption of M121 production, 7AF argued as follows:[17/]

> *"The 15,000-lb. liquid-filled device currently undergoing testing at Tonopah appears attractive from several aspects. The binary liquid explosive can be shipped and stored in its two component parts, which are non-explosive when not combined. The advantage of storing non-explosive items rather than larger explosive packages should not be overlooked. Further, in view of the requirement for even larger HLZ (helicopter landing zone) construction devices, it appears that the liquid explosive system offers a great deal of flexibility and growth potential."*

Initial Drops

The results of the Nevada tests showed that the larger weapon had significantly greater blast effect and peak overpressure than the M121, but, pending comparison drops between the two in the SEA area, the M121 was given its first tactical employment in support of Operation Taylor Common in I Corps Tactical Zone. Under TPQ-10 (a Marine radar system comparable to the USAF's MSQ-77) guidance, ten of the 10,000-lb. bombs were dropped between 12 and 20 December 1968. The average miss distance from the desired point of impact was 103 meters, although it should be noted that the greatest miss distances occurred on the first four drops, when all concerned were still in the learning stage.[18/] These were termed training and test drops for the system; therefore, LZ size and suitability were not recorded.[19/]

[redacted]

Following the initial drops, the use of the M121 as an HLZ clearing device became standard procedure, with requests for its use totalling more than 20 per month. The long-awaited opportunity to compare the effects of the 10,000 and 15,000-lb. devices came in the spring of 1969, when the first of the experimental 15,000-lb. CD-1s arrived in SEA. The CD-1 (its production nomenclature was later changed to BLU-82/B) was virtually handmade, but nevertheless (or, perhaps, because of this fact) functioned perfectly. On 11 May 1969, two CD-1s and two M121s were dropped, to permit a comparison of the two weapons. The findings of the evaluation were as follows:[20/]

> *Handling and loading of the CD-1 were virtually identical to those of the M121, with the exception of the requirement for covered storage. Release and retardation were virtually identical to those of the M121. Release and retardation systems for both of the test CD-1s operated without malfunction or incident. Delivery accuracy was consistent with current M121 drops using MSQ radar.*
>
> *Evaluation of the relative effectiveness was by II Field Force personnel and by photographic analyses. Although the CD-1 did not produce the required five-helicopter zone, it produced a cleared area approximately two-and-one-half times the area created by the M121. Both weapons left some residual stumps of varying size.*

Even though the CD-1 did not satisfy the requirements of the SEAOR 168 for a five-helicopter zone--the figure "five" as an ideal had in fact been snatched out of thin air at random, rather than being the product of meticulous estimates and careful calculations--the results were impressive enough to prompt the Commander, Seventh Air Force, to press for use of the CD-1 in lieu of revived production of the M121.[21/] Of additional

[redacted]

importance in this decision was the fact that the 15,000-lb. production version of the BLU-82/B could be in the theater by early 1970, while the lead time for resuming production of the M121 was placed at 15 months.[22]

Even so, it was decided to continue the use of the M121 until the bombs in inventory were exhausted, even after the BLU-82/Bs began arriving in Vietnam in February 1970. The first drop of the production models took place on 23 March; thereafter, delivery was carried out as a matter of course.[23] Either of the bombs might be employed at a given location, the choice being dependent upon many variables, such as inventory availability or the nature of the target. As of 1 October 1970, 323 bombs had been used for HLZs and fire base construction, 216 of them being M121s and 107 BLU-82s. With the dropping of the last M121 on 8 August 1970, the inventory of that munition was exhausted.[24]

CHAPTER III

COMMAND, CONTROL, AND EXECUTION

A tortuous chain of command, control, and execution was involved in the use of the heavy bombs for helicopter landing zone construction. Since the field commander would be the ultimate user of the zone, it was he who initiated the request, through channels, to MACV. (See Flow Chart, Figure 1.) The Army (or Marines, as the case might be) then performed the targeting, while MACV controlled the bombs, since these items were a definitely limited resource. Headquarters, 7AF, was responsive to MACV direction, and, upon receiving approval for a delivery, directed the 834th Air Division to conduct the drop operation.[25/]

All bombs, both M121 and BLU-82/B, were stored at Cam Ranh Bay, and it was there that the operational aspect of the deliveries originated. Detachment 2 of the 834th Air Division was located at Cam Ranh Bay, from which base it provided the over-all management function. Making up a part of Detachment 2 were both C-130B aircraft and personnel TDY from the 463rd Tactical Airlift Wing at Clark AB, Republic of the Philippines, which came under the operational control of the 834th Air Division while they were at Cam Ranh Bay. These crews received ground and airborne training in Commando Vault loading, handling, communications, and delivery techniques prior to their arrival in-country.[26/] While actual loading of the bombs into the C-130Bs was accomplished by the 14th Aerial Port Squadron, once aboard the aircraft, the munitions were rigged for drop by personnel

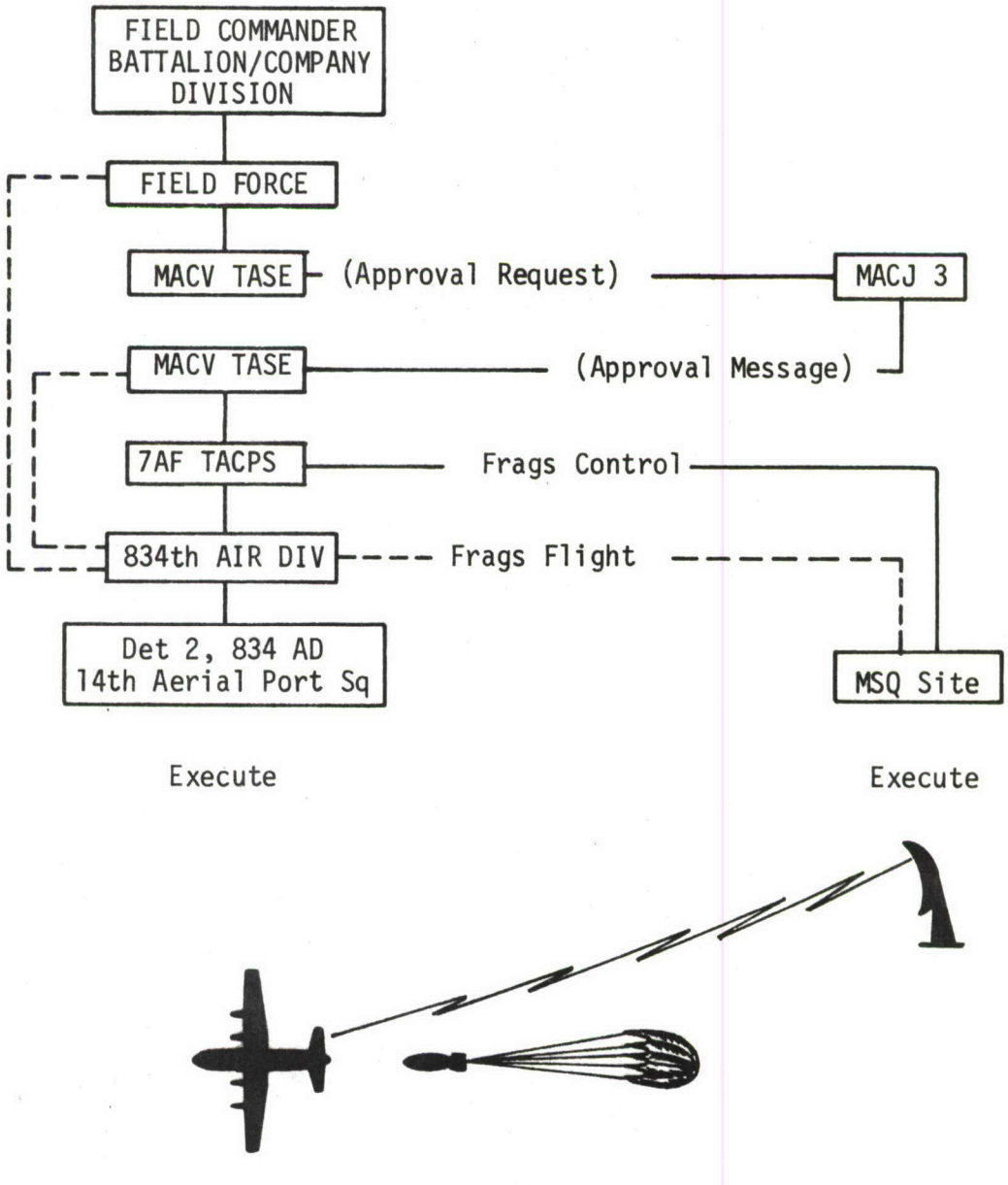
of Detachment 2, and fuzed by ordnance specialists.[27] The Hercules itself required no modification other than temporary installation of an X-band radar transponder beacon to aid the MSQ site in precision-tracking it.[28]

In view of the recognized destructive power of the bomb, intricate and detailed coordination among all action agencies was necessary to avoid the possibility of a short round. These agencies included the ground commander involved, the appropriate Direct Air Support Center (DASC), the Strike Plans Branch of the Tactical Air Control Center, 834th Operations, and the radar site which was to direct the drop.[29] Double and triple checks were made, in the interests of safety to non-combatants and friendly military forces, before one of the bombs was actually released. Among the many procedures which followed the issuance of an execution order were the following:

- The FAC assigned to the ground unit reviewed in detail the specific coordinates and features of the desired zone with the ground commander.
- 834th Air Division assigned a Combat Operations Mission Coordinator to stage at the forward location and fly with the FAC; he also verified coordinates, the requested TOT, and terrain features for target suitability.
- The frag tape printout was proofread and checked for accuracy by the TACPS Staff Operations Officer and the Chief of Strike Plans before the message was released.
- The target was defined by eight-figure Universal Transverse Mercator coordinates, both in figures and spelled out. Such a message might, for example, define the target as "Yankee Tango One Three Six Five Zero Five Eight Nine (YT 13650589)." This placed the DPI (desired point of impact) within a ten-meter square.

Figure 1

(C) Request-execute flow chart for Commando Vault Bomb Drops.



. If any of the agencies involved--TASE (Tactical Air Support Element--the Army coordination element collocated with 7AF TACC), TACPS, 834th Air Division, the MSQ site, or the field commander--detected any discrepancies regarding target location, time over target, run-in heading, or anything else that might endanger friendlies, clarification or amendment was immediately requested.

Early in the program, as much as six days' lead time was required by the field commander before he could expect a Commando Vault-created landing zone; however, continued efforts by 7AF TACC and streamlining of procedures through experience reduced this lead time to as little as three days. From the time the request was received by the TASE and an approval message returned by MACV J-3, the 834th Air Division required 48 hours for the drop. When the aircraft and crews were already in-country, this requirement could be dropped to 24 hours, provided the need were urgent. 31/

CHAPTER IV

EQUIPMENT AND OPERATION

A description of the two heavy bombs used in Commando Vault provides a rough comparison of their respective destructive powers. The M121 was approximately 9-1/2 feet long, nearly four feet in diameter, and weighed 10,800 pounds, of which 8,050 pounds comprised the explosive agent, Tritonal. The BLU-82/B measured out at 11-1/2 feet in length, without fuze extender, and 4-1/2 feet in width. Its filled weight was 15,000 pounds, the explosive agent being 12,600 pounds of ammonium-nitrate powdered-aluminum slurry called DBA-22M.* It had been intended initially that the two components would be shipped separately to Cam Ranh Bay, where they would be mixed and the containers filled. However, the difficulties of adequately training personnel on the job within the 12 months of service in Vietnam before rotation dictated that the containers be filled at the factory and shipped to Cam Ranh Bay separately from the fuzes and booster charges.[32/]

*DBA-22M was a powerful explosive made up, in part, of particulate aluminum, ammonium nitrate, water, thickeners, and stabilizers--though a detailed chemical analysis was proprietary information, solely known to the manufacturer and supplier, IRECO Chemicals, of Salt Lake City, Utah. Curiously enough, Air Force interest in DBA-22M had originated in Sandia Laboratories' need for a conventional high explosive that could be used in a test device capable of producing a simulated nuclear cloud for the exercise of RB-57 sampler aircraft under Project Cloudmaker. This device, incidentally, was to weigh 45,000 pounds! (By way of comparison, the largest World War II bomb had weighed 23,000 pounds.)

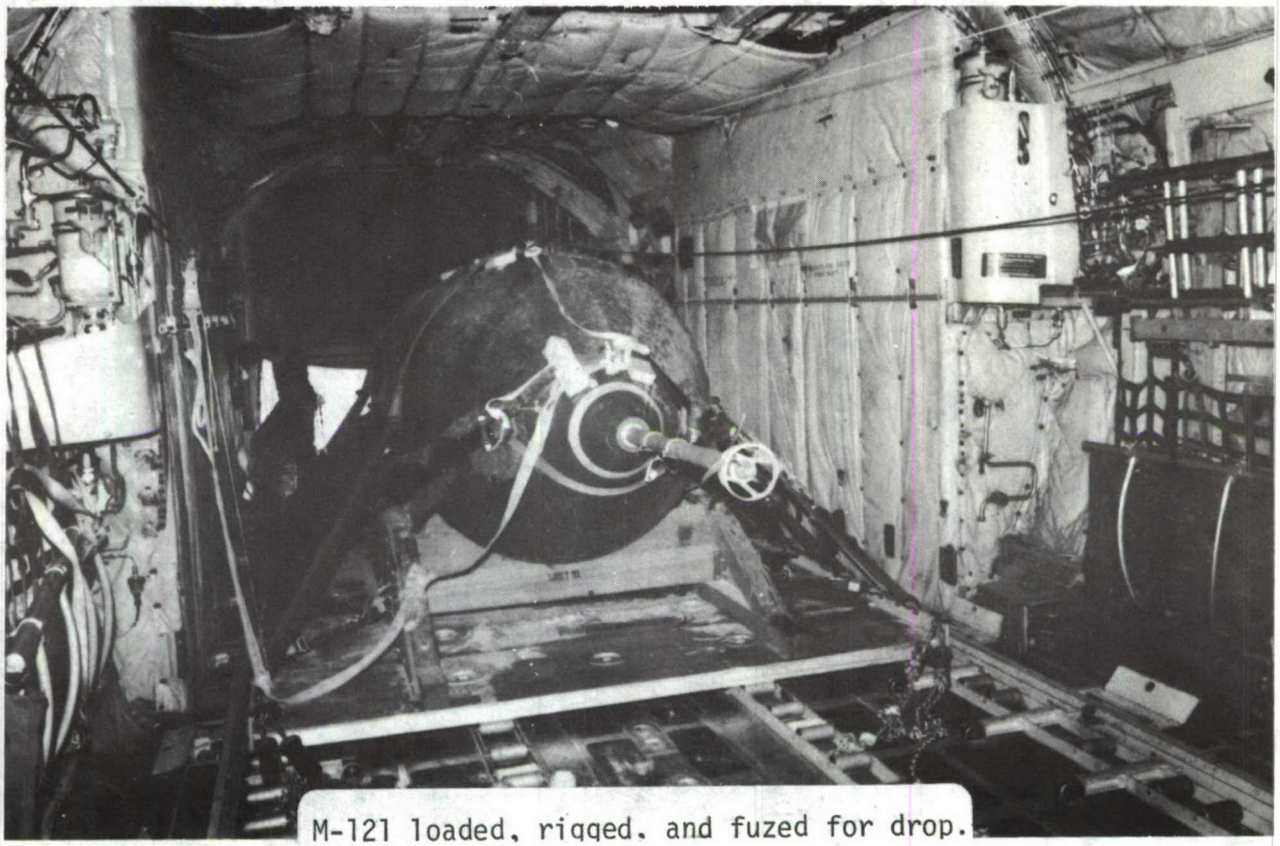
The weapons were loaded by crane and muscle into cradles on pallets at Cam Ranh Bay, then subsequently put aboard the C-130, where they underwent final rigging and fuzing. (Figure 2.) The complex fuzing system consisted of an M904E2 fuze, an M1A1 fuze extender (a three-foot charge-filled rod on the nose), two BBU-23/B fuze boosters, a T45E7 or M148 nose adapter booster, a T46E4 or M147 tail adapter booster, two M9 non-delay fuze delay elements, a fuze drive assembly, and various arming wires, guides, clips, and other assorted items. The purpose of the fuze extender was to cause detonation above the ground, creating greater outward blast effect and lessening the chance of deep cratering, which would defeat the purpose of the landing zone. In addition, an M905 fuze in the tail provided back-up for the primary system in the nose.[33/]

Two M121s could be loaded aboard the aircraft and dropped on separate runs. If one bomb created a satisfactory LZ, the C-130 could return to base with the other bomb still aboard; or, if the landing zone was not considered adequate, the pilot could bring the aircraft back for another run to enlarge the zone. In one instance, an M121 was dropped, creating a good one-ship zone. The aircraft came around for another drop, and the MSQ operator told the crew they would lay the second one 30 meters from the first. As it turned out, the bomb actually hit 41 meters from the first.[34/]

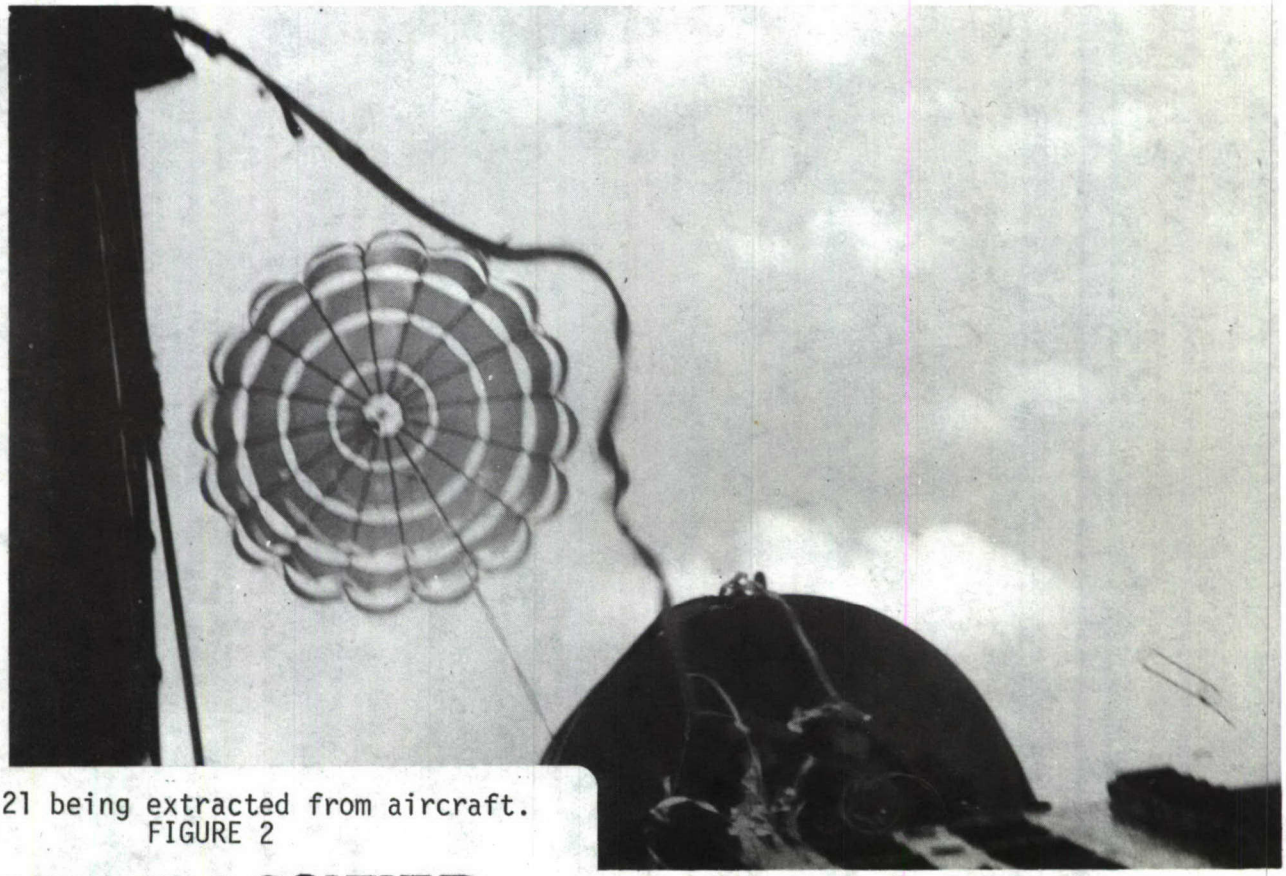
Although the cargo compartment of the C-130 was large enough for two BLU-82/B bombs, only one was carried, inasmuch as center of gravity characteristics of the Hercules would render a safe landing impossible, should circumstances require a return to base with one bomb of a two-bomb load still aboard.[35/]

Following departure from Cam Ranh Bay, the Commando Vault aircraft proceeded to the target area, where it worked directly with the DASC (Direct Air Support Center), the MSQ-77 precision radar controller, and the FAC, accompanied by an 834th Combat Operations Mission Coordinator. Any of these could cancel the drop, as could the ground commander, for a variety of reasons. Coordination had already been arranged between the 834th Air Division and the MSQ site to ascertain that the target area was not masked from the radar and that radar "up" time was available (many times TOTs had to be adjusted because the radar was preempted for Arc Light or other planned missions); so cancellation for these reasons was rare. However, if the ground commander, FAC, or 834th coordinator determined that the terrain was unsuitable, if weather precluded the FAC or coordinator from seeing the target, or if friendlies were within 1,500 meters of the desired point of impact, the mission would be cancelled. Fifteen hundred meters was the minimum distance from DPI for any non-combatants or friendly forces, but it was highly recommended that any troops intending to use the zone be 3,000 meters from the impact point, owing to the psychological effect of the blast.[36/]

When the FAC gave instructions to proceed, the radar controller vectored the aircraft through one or more practice runs, usually at 6,000 or 7,000 feet above ground level (although some drops were made up to 13,000 feet), before the final run.[37/] When procedures were considered exact, the aircraft made the drop under precise radar control. The controller took into consideration the ballistics characteristics of the weapon, wind forecasts as supplied by the 1st Weather Group, and the altitude of the drop aircraft, and these were all run through the



M-121 loaded, rigged, and fuzed for drop.



M-121 being extracted from aircraft.
FIGURE 2

[redacted]

radar computer prior to drop.[38]

With the palletized bomb ready, the following sequence of events went into effect:[39]

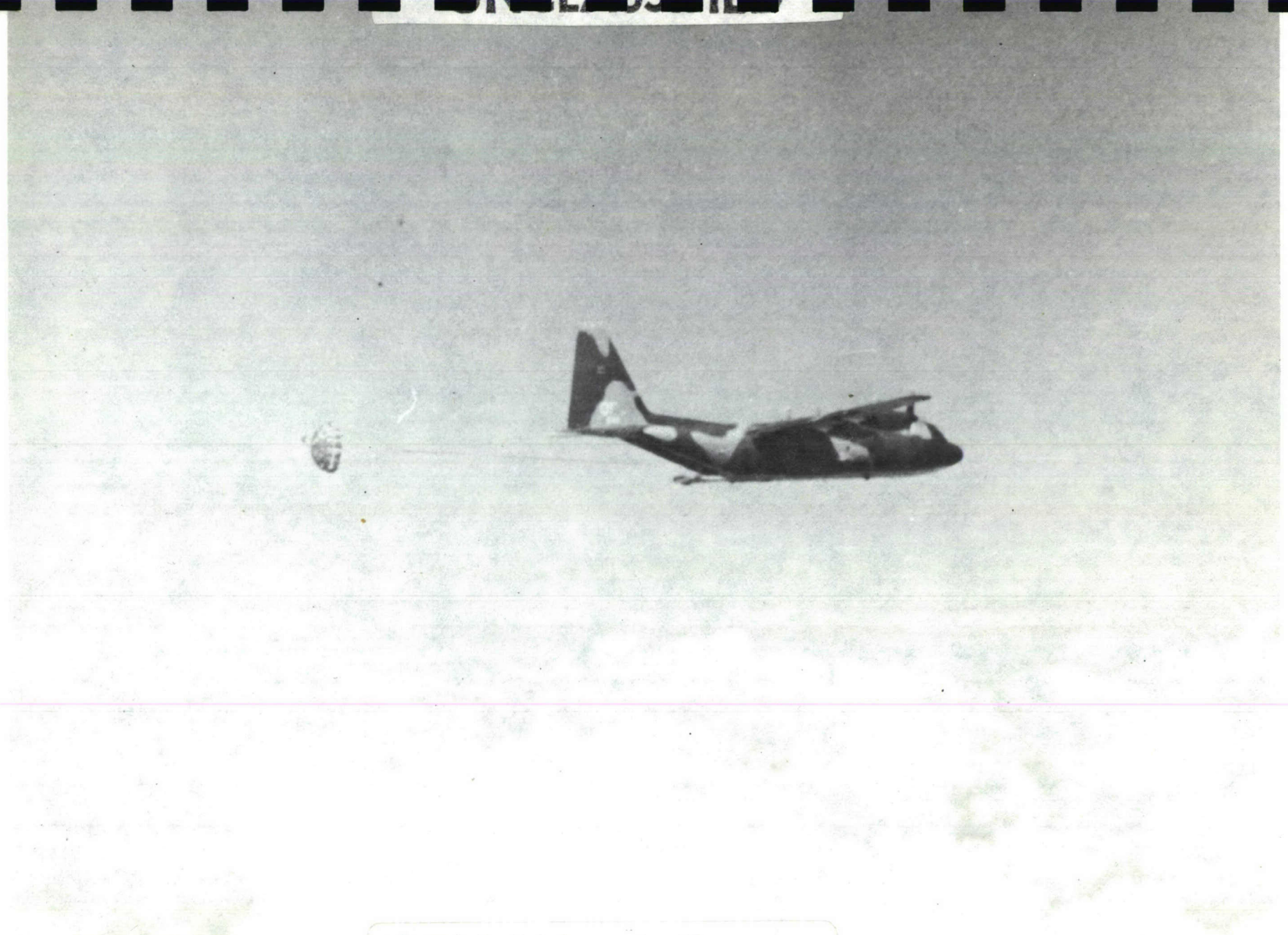
- Six minutes before bomb release, the loadmaster released the left-hand cargo lock. This left only the right-hand lock holding the pallet on the rails.
- At 30 seconds before release the co-pilot remotely streamed the extraction chute behind the opened ramp.
- As the radar controller counted down the final seconds with a 5, 4, 3, 2, 1 count, the loadmaster prepared and, on the command, "Mark," released the right-hand locks.
- A knife on the static line severed the webbing that secured the bomb to the cradle and platform as the bomb cleared the ramp. Lanyards attached to the left-hand nose collar clevis and to the parachute deployment bag in turn initiated arming of the nose and tail fuzes respectively, as the 24-foot slotted chute which stabilized the bomb deployed from the aircraft and pulled the bomb from its wooden cradle. A brush deflector on the M1 fuze extender enabled the bomb to pierce the jungle canopy before exploding three feet above the ground.

With 6,000 feet AGL the normal drop altitude and at 150 knots true airspeed, the average time from release to impact was approximately 26 seconds. This placed the aircraft a little more than a mile from the blast. The explosion could be heard inside the aircraft, and the shock wave felt, but overpressure had attenuated at that distance to such an extent that it was barely noticeable.[40] (Photographs of the drop sequence, Figures 3-10, depict the operation.)

At ground zero, however, the blast was devastating. The M121 cleared an area approximately 60 meters in diameter. The BLU-82/B extended that

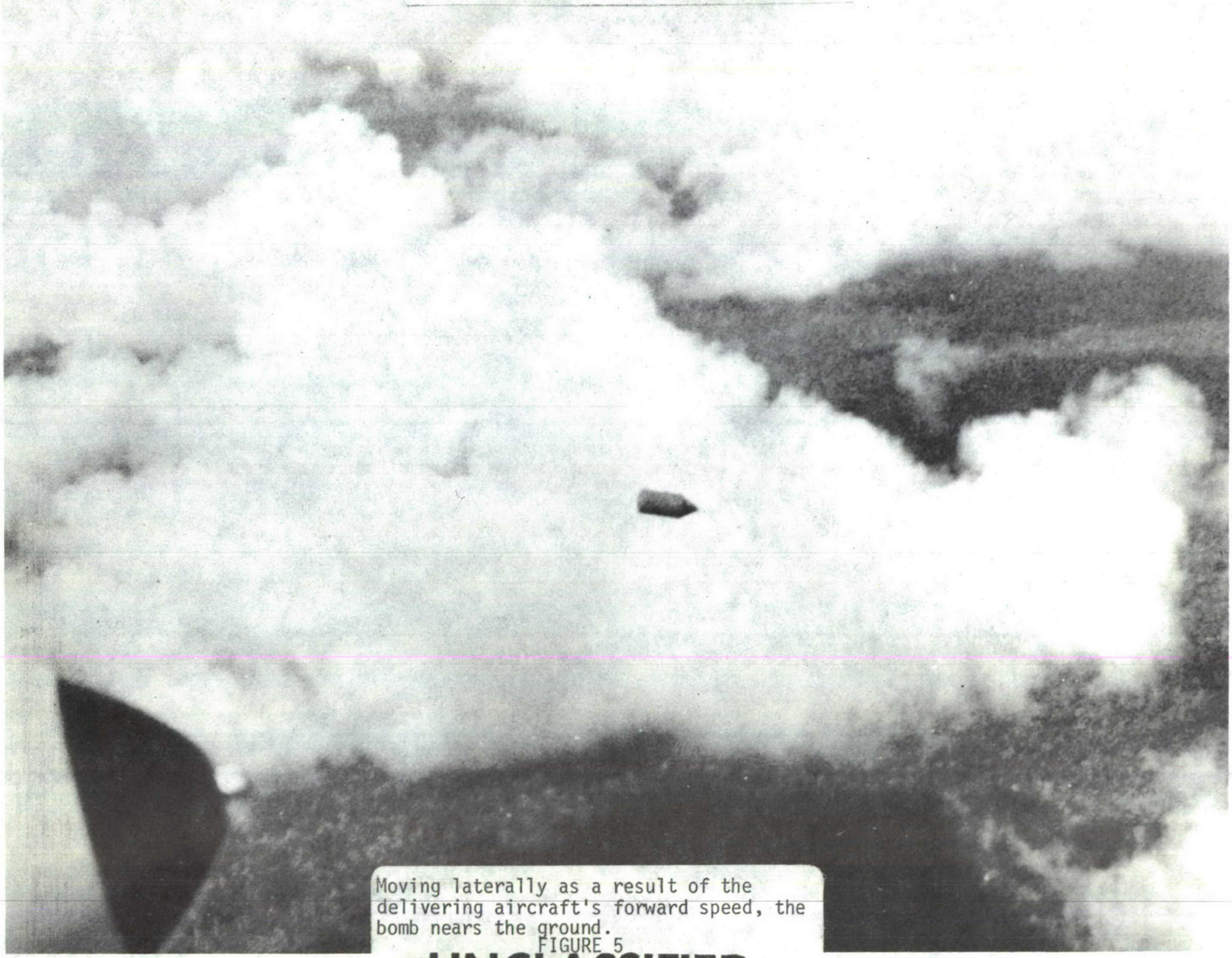
to about 80 meters. In the case of the M121, this meant the creation of a "cleared" area of roughly 2,800 square meters; while the BLU-82/B increased the affected terrain to over 5,000 square meters.[41] Flash from the explosion burned foliage off trees and brush out to about double the radius of the usable zone proper. To use the term "cleared" is, however, not strictly accurate, as can be seen from the photographs: numerous stumps invariably remained standing. However, it was also true that the blast generated overpressure sufficient to uproot trees three feet in diameter near the point of impact, and continued outward far enough that Viet Cong found as far as 600 meters from ground zero remained shocked and dazed as long as 18 hours after the explosion.[42]

Although the explosive force did not fully satisfy the SEAOR requirements, several spinoff benefits accrued to help make the project a successful one. Employed over proper terrain, Commando Vault provided at the least a one-ship landing zone; and, almost as often, it created a two-ship clearing. The first helicopter or helicopters into the zone carried security troops to set up a defensive perimeter. These men were assured of two vital conditions: One, the area immediately in or around the zone would be completely cleared of booby traps and punji--the needle-sharp bamboo sticks implanted in the ground to inflict foot and leg injuries upon friendly forces. Two, there would normally be no effective enemy forces within half a kilometer of the drop zone, blast pressure having incapacitated them, and the psychological effect upon those who might otherwise be effective was shattering. The proof of



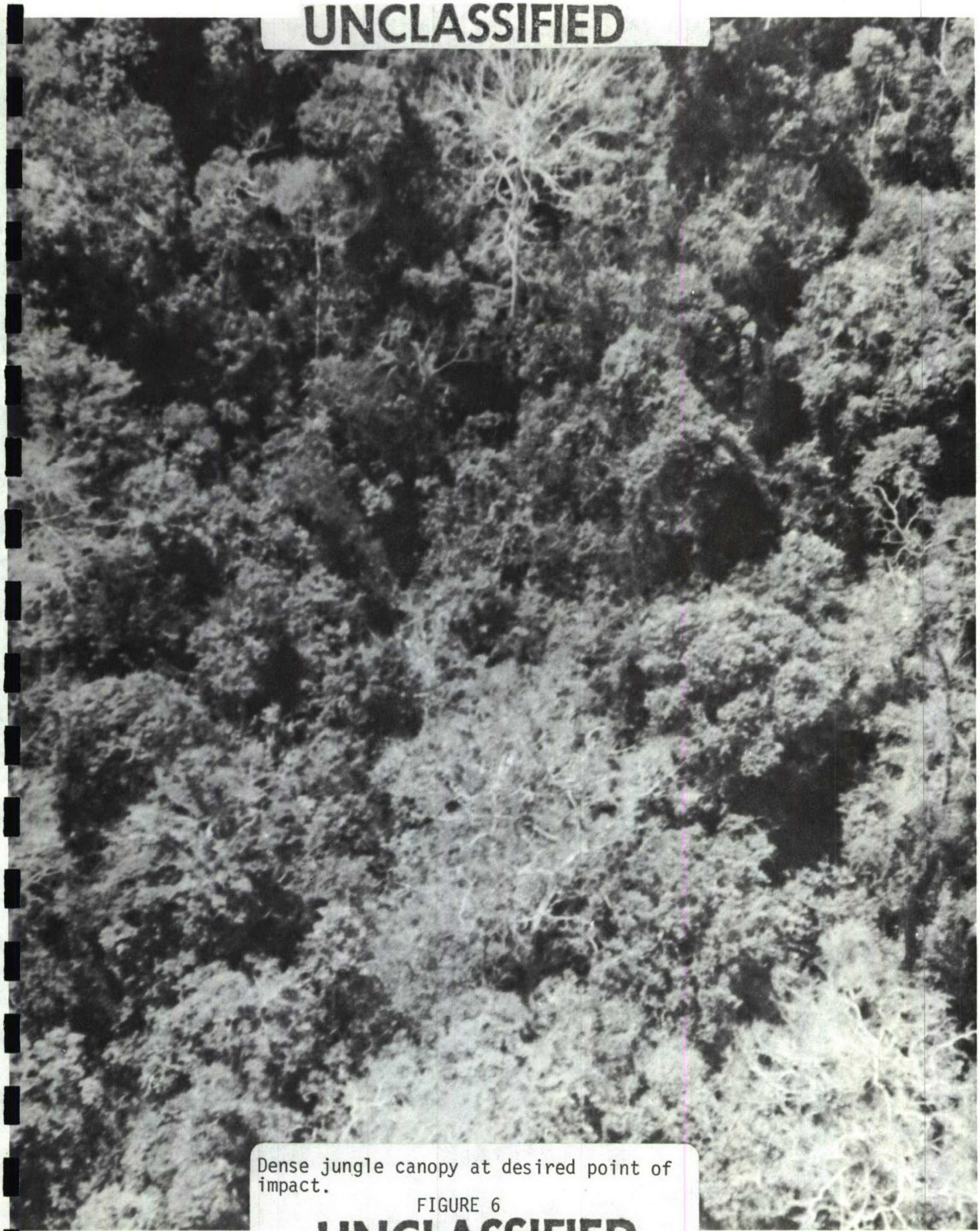
Parachute triggers extraction process
from the C-130 aircraft.
FIGURE 3

The parachute-extracted bomb exits the C-130 and commences descent to the target.
FIGURE 4



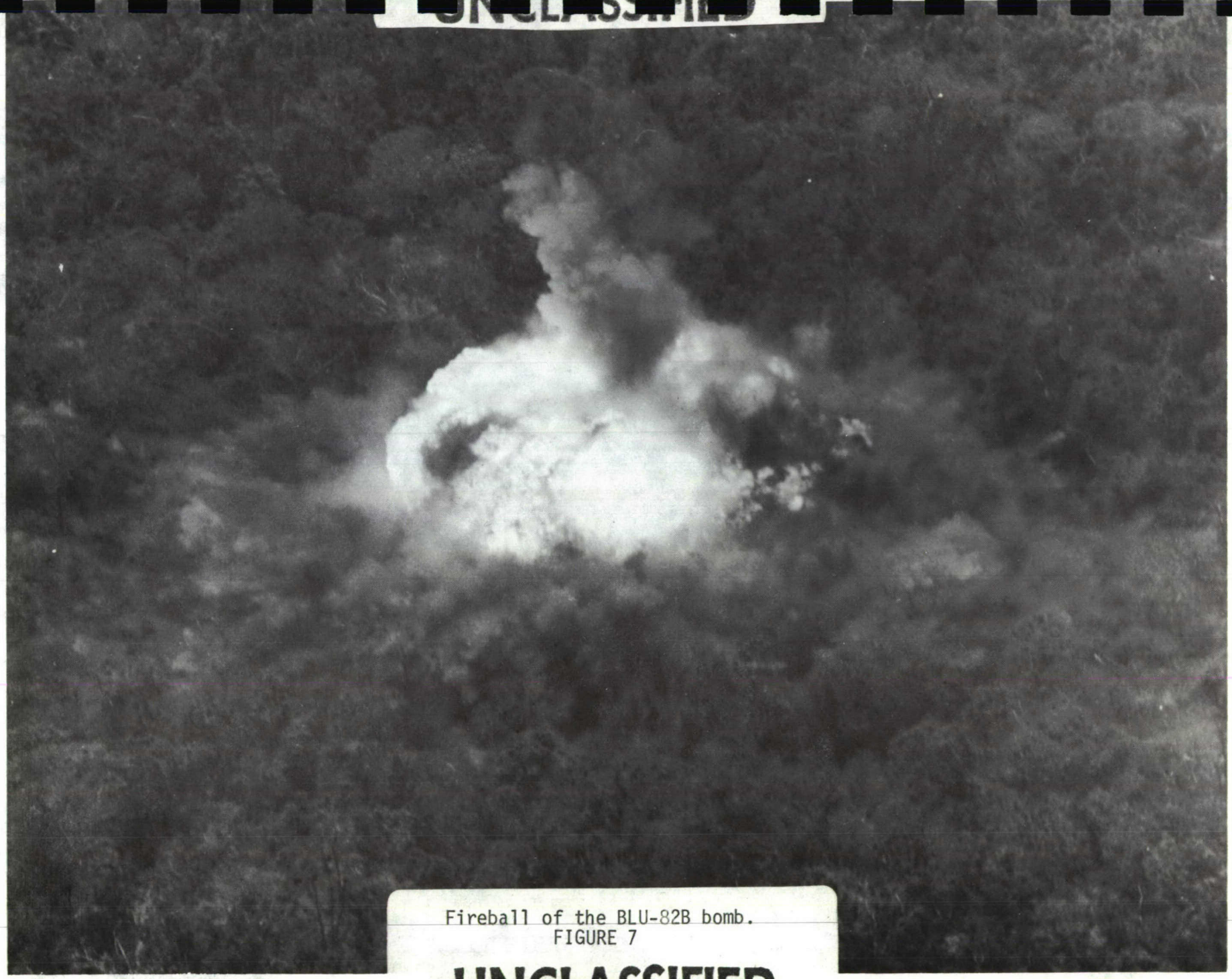
Moving laterally as a result of the delivering aircraft's forward speed, the bomb nears the ground.

FIGURE 5

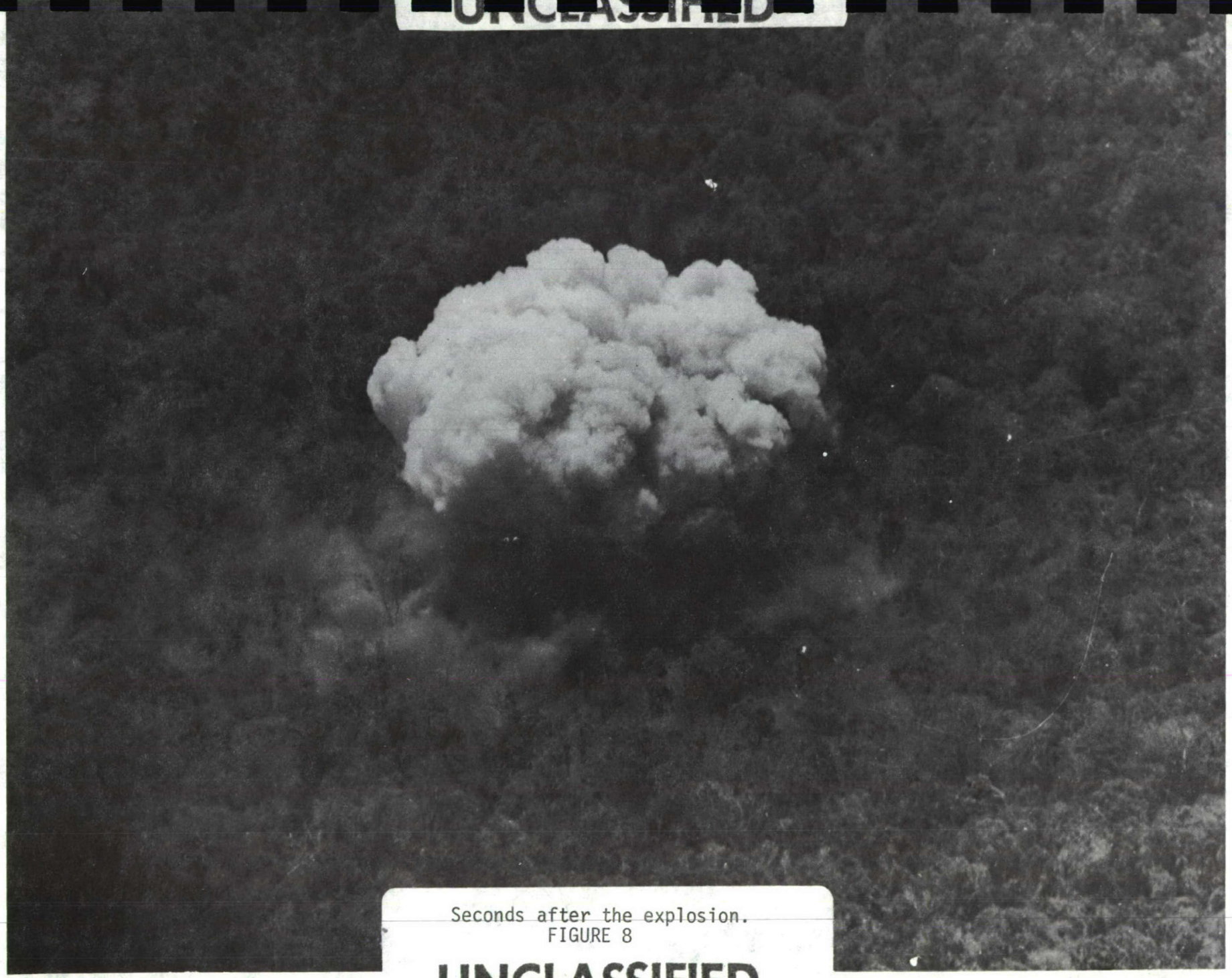


Dense jungle canopy at desired point of impact.

FIGURE 6



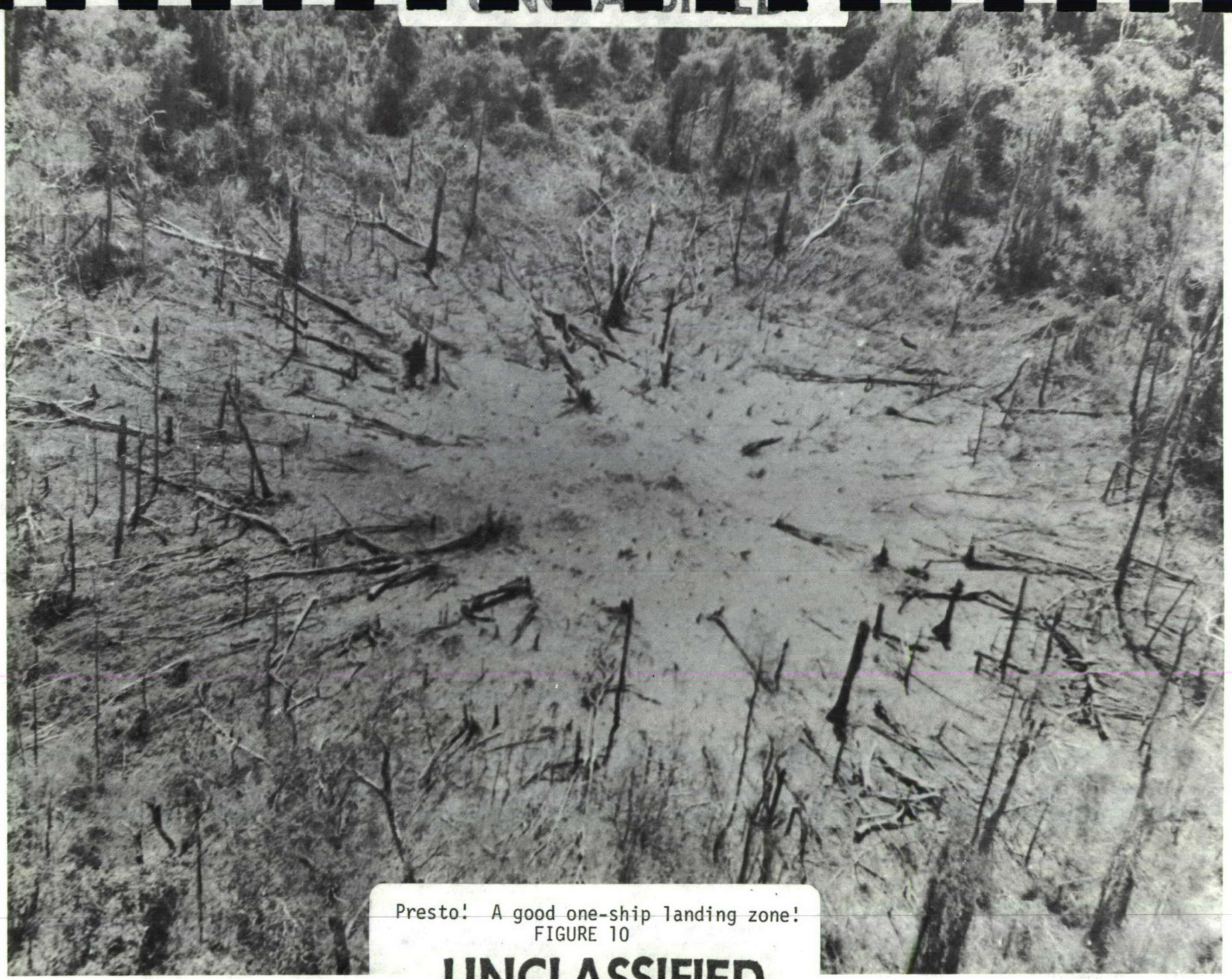
Fireball of the BLU-82B bomb.
FIGURE 7



Seconds after the explosion.
FIGURE 8

Mushroom cloud rises over the impact point.

FIGURE 9



Presto! A good one-ship landing zone!
FIGURE 10

these physical and psychological effects was that assault forces entering the HLZs immediately after the blasts were usually unopposed.[43/]

Once the security forces were in, engineers followed immediately, bringing in chain saws, shovels, and bulldozers to enlarge the LZ to one capable of receiving five or six helicopters.

Not counting the M121 drops, the results of 107 BLU-82/B missions showed the following:[44/]

. Unsuitable zones	17
. One-ship zones	44
. Two-ship zones	36
. Three-ship zones	8
. Four-ship zones	2

Since many of the unsuitable zones were rendered so by unfavorable terrain features (for example, those bombs which were dropped on a ridgeline) or by lack of knowledge of the actual surface features concealed under the heavy jungle canopy--including large boulders and the like, the degree of success achieved by the Commando Vault drops appears remarkable--the more so if one recalls that the landing zones were completed within minutes or hours, as contrasted with the minimum of several days required when they had to be constructed by standard engineering methods.

Of the total attempted HLZs, 15.88 per cent were not suitable, 84.12 per cent could accommodate one or more helicopters immediately, and 33.64 per cent were capable of immediately accepting two aircraft. The average miss distance of the drops executed by the MSQ-77/834th Air Division combination--considering both M121 and BLU-82/B bombs--was 58 meters.

A laudable 62.8 per cent fell within 50 meters, and 95.2 per cent came within 250 meters--a proximity more than adequate for most ground operations.[45/]

The Cambodian Operation

At the request of the Lon Nol government in Cambodia, Commando Vault operations were conducted in the struggle for that country following the ouster of Prince Norodom Sihanouk. The first BLU-82/B was dropped there at XU 55200120 (UTM coordinates) in the southeastern portion of the country, not far from the RVN border, on 1 May 1970, and before the U.S. forces pulled out, 15 more BLU-82s were dropped. In addition, four M121s, among the last in the inventory, were released in June. These later created three usuable landing zones--two of them two-ship zones. The fourth bomb dudded when it did not separate from the cradle. Of the BLU-82Bs, 13 of the 16 made suitable zones: eight one-ship, four two-ship, and one three-ship. The three which did not create usable LZs either landed on steep slopes or left too many stumps for helicopters to maneuver between.[46/]

All in all, the Commando Vault program proved a workable, highly economic method of accomplishing what had hitherto been a time-consuming, dangerous, laborious, and costly task. In creating "instant HLZs" for the ground forces, Commando Vault reaffirmed the flexibility of modern air power.

FOOTNOTES

1. (S) Project CHECO Report, "Operation Thayer/Irving," 12 May 1967, extracted material (C) Interview with Captain Lawrence L. Miller, 14 Jan 1967.

2. (S) "Operation Thayer/Irving," extracted material (C) Interview with 1st Lt Johnny Hohenshelt, 13 Jan 1967.

3. (C) Ltr., Lt Colonel William C. Ferguson, Chief, Mun. Tech. Serv. Div., DCS/Materiel, Hq PACAF, to Directorate of Tac. Eval. (DOVD), DCS/Operations, Hq PACAF, sub.: Project CHECO Report, Commando Vault, 12 Nov 1970.

4. (S) EOD Report 377-67-304. Also, Historical Data Report, Hq 7AF DMW, 1 Oct-31 Dec 1967. (Downgraded to (C))

5. (S) Historical Data Report, 7AF DMW, 1 Jan-31 Mar 1968. (C)

6. (OUO) Test Report, ADTC-TR-69-17, Subj: Combat Trap, April 1969.

7. Ibid.

8. Ibid.

9. Ibid.

10. (U) 834th Air Division Briefing, undtd.

11. Ibid.

12. (S) Msg, Hq 7AF to CINCPACAF, Subj: SEAOR 168, HLZ Clearance Weapon, 170755Z Mar 1969. Extracted material (C).

13. (C) Msg, 834th Air Division to Hq 7AF DOOA and Addees, Subj: Commando Vault, 060016Z Feb 1970.

14. (S) Msg, Hq 7AF to CINCPACAF, Subj: SEAOR 168, 170755Z Mar 1969.
Ref A (C) Msg, COMUSMACV, 071511Z Nov 1968.
Ref B (S) Msg, 7AF DPLR, 080130Z Jan 1969.
Ref C (S) Msg, 7AF DPL, 311330Z Jan 1969.
Ref D (S) Msg, CINCPACAF/DO, 110217Z Feb 1969.
Ref E (C) Msg, CSAF/AFRDQR, 041851Z Mar 1969. (Material extracted from all cited messages (C).

15. (U) Development Report SC-DR-70-376: Design, Development, and Production of the BLU-82/B Bomb and BBU-23/B Booster, June 1970, pp. 9-10.

16. (U) Ibid., p. 44.

17. (S) Msg, Hq 7AF to CINCPACAF, Subj: SEAOR 168, 170755Z Mar 1969.

18. (C) Discussions with Lt Colonel Donald K. Cole, 834th Air Division Operations, 6 Oct 1970. Also, (C) 834th Air Div Commando Vault Log.

19. (C) Commando Vault Log.

20. (S) Narrative Chronology, 7AF DCS/Plans-Requirements Directorate Input to 7AF History, Apr-Jun 1969. (Extracted material (C))

21. Ibid.

22. (S) Narrative Chronology, 7AF DCS/Plans-Requirements Directorate Input to 7AF History, Apr-Jun 1969. (Extracted material (C))
(S) Msg, Hq 7AF to CINCPACAF, Subj: SEAOR 168, 170755Z Mar 1969.

23. (C) Commando Vault Log.

24. Ibid.

25. (C) Discussions with Lt Colonel Donald K. Cole and Lt Colonel Gerald R. Lane, 834th Air Division Operations. Hereafter cited as Discussions with Lt Colonels Cole and Lane. Also, (U) 834th Commando Vault Briefing.

26. Ibid.

27. Ibid.

28. Ibid.

29. (C) 7AF Form 4, Subj: Investigation of TACP Frag Procedures, 10 Jan 1970.

30. (C) 7AF Form 4, Subj: Investigation of TACP Frag Procedures, 10 Jan 1970.
(C) Discussions with Captain Gordon L. Boozer, Operations Staff Officer, 7AF TACPS, and (C) Discussions with Major Roger U. Obermeier, USA, Operations Staff Officer, TASE (MACV J3-071).

31. (C) Discussions with Lt Colonels Cole and Lane.

32. (U) Technical Data from 834th Air Division.
(C) Discussions with Lt Colonels Cole and Lane.

33. (C) Discussions with Lt Colonels Cole and Lane.

34. (C) Ibid.
(U) Interview with SMSgt George E. France, 600th Photo Sq, 3 Jun 1970. Hereafter cited as Interview with SMSgt France.

35. (C) Discussions with Lt Colonels Cole and Lane.

36. (C) Ibid.

37. (C) 834th Air Division Commando Vault Logs.
(U) 834th Air Division Commando Vault Briefing.

38. (C) Discussions with Lt Colonels Cole and Lane.

39. (U) 834th Air Division Commando Vault Briefing.

40. (C) Discussions with Lt Colonels Cole and Lane.

41. (C) Ballistics Tables for BLU-82/B Bomb.
(U) 834th Air Division Commando Vault Briefing.

42. (C) Interview with SMSgt France.

43. (C) Discussions with Lt Colonels Cole and Lane.

44. (C) 834th Air Division Commando Vault Logs.

45. (C) Ibid.
(C) Discussions with Lt Colonels Cole and Lane.

46. (C) 834th Commando Vault Logs.

GLOSSARY

AGL	Above Ground Level
BLU-82/B	15,000-pound bomb
CTZ	Corps Tactical Zone
DASC	Direct Air Support Center
DPI	Desired Point of Impact
EOD	Explosive Ordnance Disposal
Frag	Portion of overall order directing mission accomplishment
FSB	Fire Support Base
HLZ	Helicopter Landing Zone
LZ	Landing Zone
MACV	Military Assistance Command, Vietnam
MSQ-77	Highly accurate ground-based Army radar
M-121	10,000-pound GP bomb
PI	Point of Impact
SEAOR	Southeast Asia Operational Requirement
TACC	Tactical Air Control Center
TASE	Tactical Air Support Element (U.S. Army)
TOT	Time over Target
TPQ-10	Marine radar system, similar to MSQ-77
TT	Teletype
UTM	Universal Transverse Mercator (Grid coordinate system)